

NIH Program Evaluation Report An Analysis of Research Publications Supported by NIH 1970-1976

NIH and NCI

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NIH PROGRAM EVALUATION REPORT

Analysis of Research Publications
Supported by
NIH and NCI

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Analysis of Research Publications
Supported by
The National Institutes of Health
1970 - 1976

National Cancer Institute

INTRODUCTION

This report presents an analytic characterization of 1970-1976 research publications supported by the National Cancer Institute. A parallel report has been prepared for each of the National Institutes of Health (except NIA and NIEHS for which sufficient data were not available). Since 1973, CHI Research (the research group at Computer Horizons Inc.) has worked under contract to NIH (N01-OD-2109) on the development and application of indicators of biomedical research activity. These reports are an outgrowth of this collaborative association.

Although publication analyses were first used to assess scientific activity at least 50 years ago, it is only in the past decade that the availability of economical large scale computer capabilities has made wide scale application feasible. "Bibliometrics," as this growing assortment of tools of analysis has come to be known, is based on the assumption that quantitative analyses of scientific journal papers, and of the citations later received by these papers, can provide sensitive indicators of activity and change in scientific productivity. The NIH - CHI research collaboration over the past several years, and related NSF supported efforts, have resulted in extensive evidence of both the validity of the assumption and the utility of the tools that have been developed. A list of relevant reports and publications will be found in Appendix A. See also NSF's Science Indicators (18). Copies of reports and publications on the NIH work can be obtained from Dr. Francis Narin at CHI or from Dr. Helen H. Gee at NIH.

The present group of reports is intended to introduce to NIH Bureaus, Institutes and Divisions (B/I/Ds) a new set of tools for program review and evaluation. The reports are based on the 1970-1977 papers published in a selected set of 275 biomedical journals. In 1982, the reports will be updated through 1980. The 275 journals contain, overall, about 80 percent of the NIH supported research papers published during this period. Limitation of the analysis to this subset of journals has been dictated by the necessity of examining each paper individually to determine acknowledgement of source(s) of support. Beginning in 1981, greatly extended and refined analyses will be made possible by the inclusion of support acknowledgement information in the National Library of Medicine's MEDLINE system. A detailed guide to the use of the tables and graphs in this report will be found in the sections that follow.

B/I/D PUBLICATION DATA SET

Journal Selection

The publication and citation information contained in this report has been drawn from an analysis of some 600,000 papers published between 1970 and 1977 in 264 biomedical research journals. The publications attributed to a given Institute represent the combined production of Intramural research programs and Extramural grant and contract support acknowledgements.

The objectives that guided the selection of 264 journals in the B/I/D Data Set were to:

- Represent all biomedical research areas by their most influential (most often cited) biomedical journal papers, and to
- Cover as many of the papers supported by NIH as possible.

An original selection of 250 journals based on these criteria was increased to 264 in response to the recommendations of B/I/D and DRG Health Science Administrators.

Since 1973 when the journals were selected, many have split or subdivided so that by 1977 there were 275 journals in the group. If the journal supplements are counted separately, they number nearly 300. (See Appendix B.)

Representativeness of the B/I/D Journal Set

Adequacy of the coverage of the 275 journal set has been assessed principally by comparing the total number of BID supported publications found in these journals with the numbers reported in the NIH 1973 Research Grants Index and the NIH Directory - Bibliography for the same year. In making these comparisons, books, abstracts, and other inappropriate (for this purpose) items were deleted from the counts. Overall, approximately 80 percent of NIH supported papers appear in the selected group of 275 journals. The following tabulation shows the percent of the total number of BID papers listed in the source documents that were covered by the 275 journal set in 1973.

% of Reported NIH Supported Papers in B/I/D Journals

NCI	85%
NEI	76%
NHLBI	76%
NIAID	75%
NIAMDD	82%
NICHD	79%
NIDR	72%
NIGMS	82%
NINCDS	76%
DRR	76%

The adequacy of the journal set was also assessed by correlating the number of papers in each biomedical "subfield" in the B/I/D set with the number of U.S. papers in the same subfields in the over 900 biomedical journals in the Science Citation Index (SCI). Correlation of the two sets was .98.

Because the B/I/D data set includes some foreign papers there were two subfields (pharmacology and urology) for which there were more papers in the B/I/D set than for all the U.S. in the SCI set. For 35 other subfields the number of papers in the B/I/D journal set ranged from 60 to 90% of the number of all U.S. papers. Three subfields had no papers in the B/I/D journal set - Addictive Diseases, Miscellaneous Clinical Medicine and Microscopy. Nine other subfields for which the B/I/D counts were low, in the 20 to 60% range, are Miscellaneous Biomedical Research (25.1%), Biomedical Engineering (29.4%), Allergy (37.6%), Nephrology (39.6%), Genetics and Heredity (42.2%), Hygiene and Public Health (46.1%), Veterinary Medicine (53%), Fertility (56.7%), and Nutrition and Dietetics (57.5%). B/I/D data on these subfields should accordingly be interpreted with due caution. It should be noted, however, that a large majority of the papers that are not covered appear in journals that report primarily the results of clinical observations on small numbers of patients rather than formal research efforts.

Data Capture

Development of the B/I/D data set required that every paper published between 1970 and 1977 in each of the 275 journals be scanned to capture BID support acknowledgement information. (Beginning in January 1981, this information will be included in MEDLINE). Up to three research support acknowledgements were tabulated and added to the original listings drawn from the Science Citation Index (SCI). When more than one source of support was acknowledged, fractional credits were assigned. The resulting lists were then matched to SCI Corporate Tapes to obtain author institutional affiliations. Up to three author institutional affiliations were added to the data set. Finally, the entire data base was matched to MEDLINE. This match provides titles of papers, the names of all authors (only the first author is captured by SCI), and MeSH headings. The MEDLINE version of the data set does not include a few of the original journals, primarily chemistry journals, not covered by MEDLINE.

Citation Frequency

The number of times each paper in the data set was cited has been added to the data base, utilizing the SCI citation tapes for 1973 to 1977. In the citation matching, B/I/D, institutional identifications, and MEDLINE data have been retained for both referencing and cited author(s).

Subject and Level Classification

A classification system for the journals has been developed in which each journal has been assigned to one of 48 subfields. The 48 biomedical subfields are also collectively grouped into "clinical medicine" or "biomedical (basic) research." The journal classification thus permits characterization of each B/I/D's research support activity into journal defined traditional disciplines such as physiology, microbiology, immunology, pathology, etc.

Journals have also been assigned to a "research level." The level concept assumes the existence of a scale ranging from clinical observation (Level 1) to basic biological (Level 4) journals. The level designations and prototype journals around which the level definition was developed are as follows:

- Level 1 - Clinical Investigation. Prototype Journal:
Journal of the American Medical Association
- Level 2 - Clinical Mix. Prototype Journal:
New England Journal of Medicine
- Level 3 - Clinical Investigation. Prototype Journal:
Journal of Clinical Investigation
- Level 4 - Basic Research. Prototype Journal:
Journal of Biological Chemistry

The level classification permits consideration of B/I/D programs from an additional useful perspective. The classification system is described in greater detail in References 1 and 2. Additional clarification of the concept may be obtained by reviewing the level assignment of each of the journals in the BID Data Set (Appendix B).

NIH AND NCI PUBLICATION TRENDS

Figures 1-3 summarize overall trends in funding and publication for the NIH B/I/Ds for which adequate data are available (NCI, NEI, NHLBI, NIAID, NIAMDD, NICHD, NIDR, NIGMS, NINCDS, DRR).

Figure 1 depicts B/I/D obligations from 1965 through 1977, in 1969 dollars. Note that there was an overall peak in funding in 1968 - 1969, followed by a brief dip and a subsequent fairly steady rise. Most of the increased funding in the early 1970s was concentrated in NCI and NHLBI, though NEI also shows a steady increase in real obligations.

Figure 2 shows corresponding publication trends. The three Institutes showing the largest upward trends over the seven year period 1970-77, NCI, NHLBI, and NEI are also the three Institutes that had the largest increases in real dollar obligations as shown in Figure 1. Relative ranks of the B/I/Ds on these figures is also very similar, although differences in ratios of basic to clinical research supported could be expected to reduce the similarity.

Figure 3 presents data specifically for NCI papers, by biomedical research level. Between 1970 and 1977 the number of NCI papers in the 275 journal set nearly doubled, from slightly more than 1800 to slightly less than 3500 papers. Increases are reflected at all research levels. In 1970, 35.7% of NCI supported biomedical papers appeared in Level 4 (basic research) journals; in 1977, 39.4% were at Level 4. Between 1973 and 1975, the number of Level 1 and 2 papers increased more rapidly than the number at Levels 3 and 4, but this apparent rate differential was eliminated by 1977.

FIGURE 1.--FUNDING FOR THE B/I/Ds

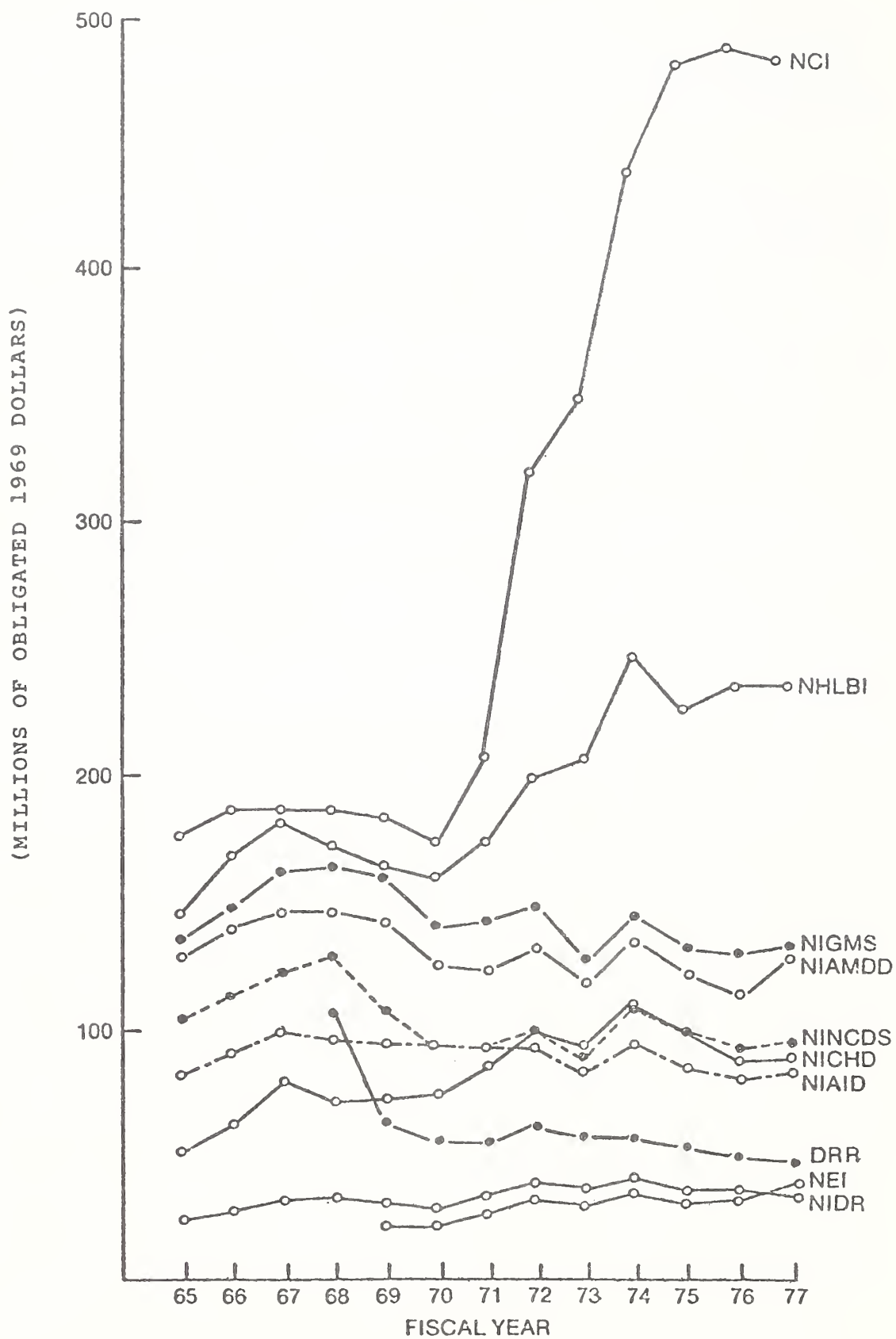
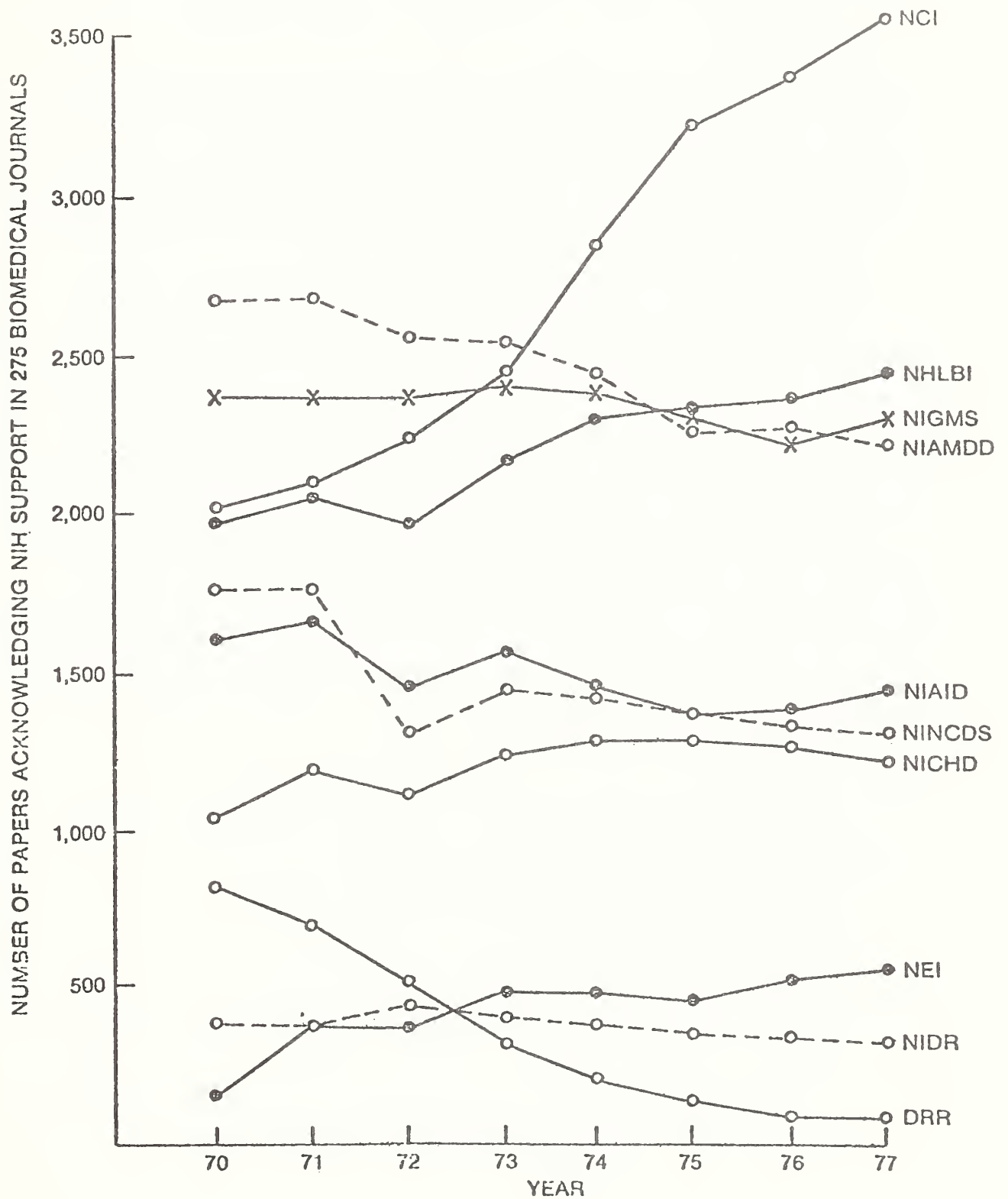


FIGURE 2.--ACKNOWLEDGEMENTS OF RESEARCH SUPPORT
 APPEARING IN 275 SCIENTIFIC JOURNALS



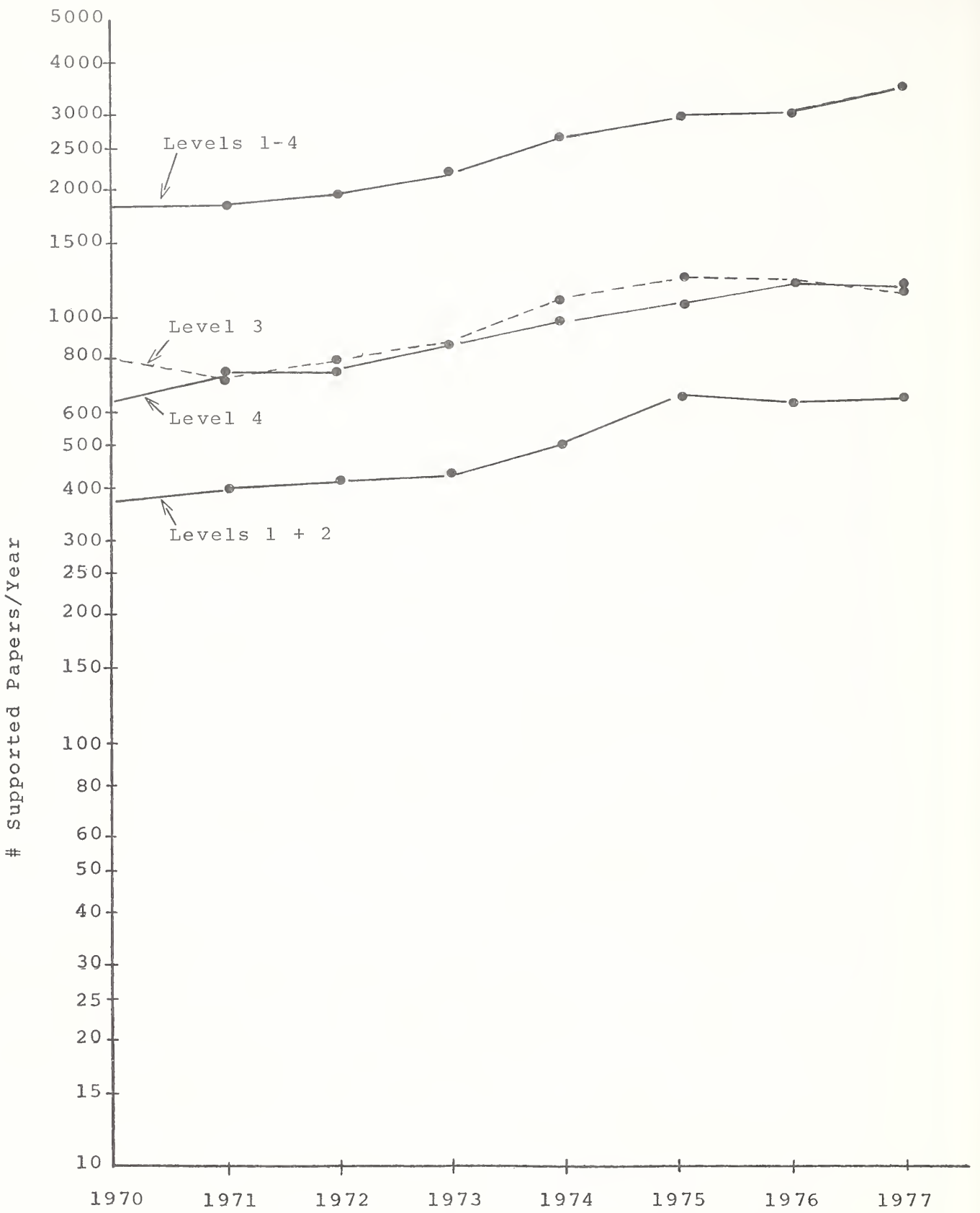


FIGURE 3: NCI SUPPORTED PAPERS IN BIOMEDICAL JOURNALS BY RESEARCH LEVEL (1977 data includes 7% estimate of 1977 papers on 1978 tapes)

NCI PUBLICATION ACTIVITY GRAPHS

The graphs in this section present a detailed bibliometric profile of NCI supported research in the 275 B/I/D journals. The publication data are summarized in Figures 4 and 5.

Figure 4 shows the percent of all U.S. papers in each of the listed scientific fields and subfields in the journal set that were supported by NCI and by NIH. The total NIH percent is shown by the open bar, and the NCI proportion by the solid bar. In the subfield of cancer, for example, approximately 47% of the papers in the 10 representative Cancer journals are supported by NIH; 39% of the total are supported by NCI. That 8% of the Cancer journal papers are supported by other B/I/Ds is illustrative of the interdependency of NIH B/I/Ds.

Figure 5 shows the distribution of "Activity Indexes" for NCI. The Activity Index is a ratio determined by dividing the percent of an Institute's papers in a subfield by the percent of all journal papers in the subfield (as the subfields are defined in the 275 journal set). Thus, the graph displays the areas in which B/I/D activity is high or low relative to the national effort in a field. Note that the NCI index for cancer journals is 10.32, indicating that NCI supported activity in this field is 10 times greater than would be expected based on the relative size of this field among all the fields represented by the 275 journals. Other fields in which the NCI activity rate is notable include Virology, Immunology, Cell Biology & Cytology & Histology, Radiology & Nuclear Medicine, and Pharmacology.

When activity graphs for all B/I/Ds are compared, a common pattern is apparent. Each Institute supports a high rate of activity in one or at most a few clinical fields that are clearly appropriate to its mission, and also supports a high rate of activity in a small number of relevant basic biomedical research fields.

FIGURE 4

NCI and NIH

% of All U.S. Papers in Each Scientific Field and Subfield Supported by the BID and by NIH

(1970-1976 combined, 275 Biomedical and Related Journals)

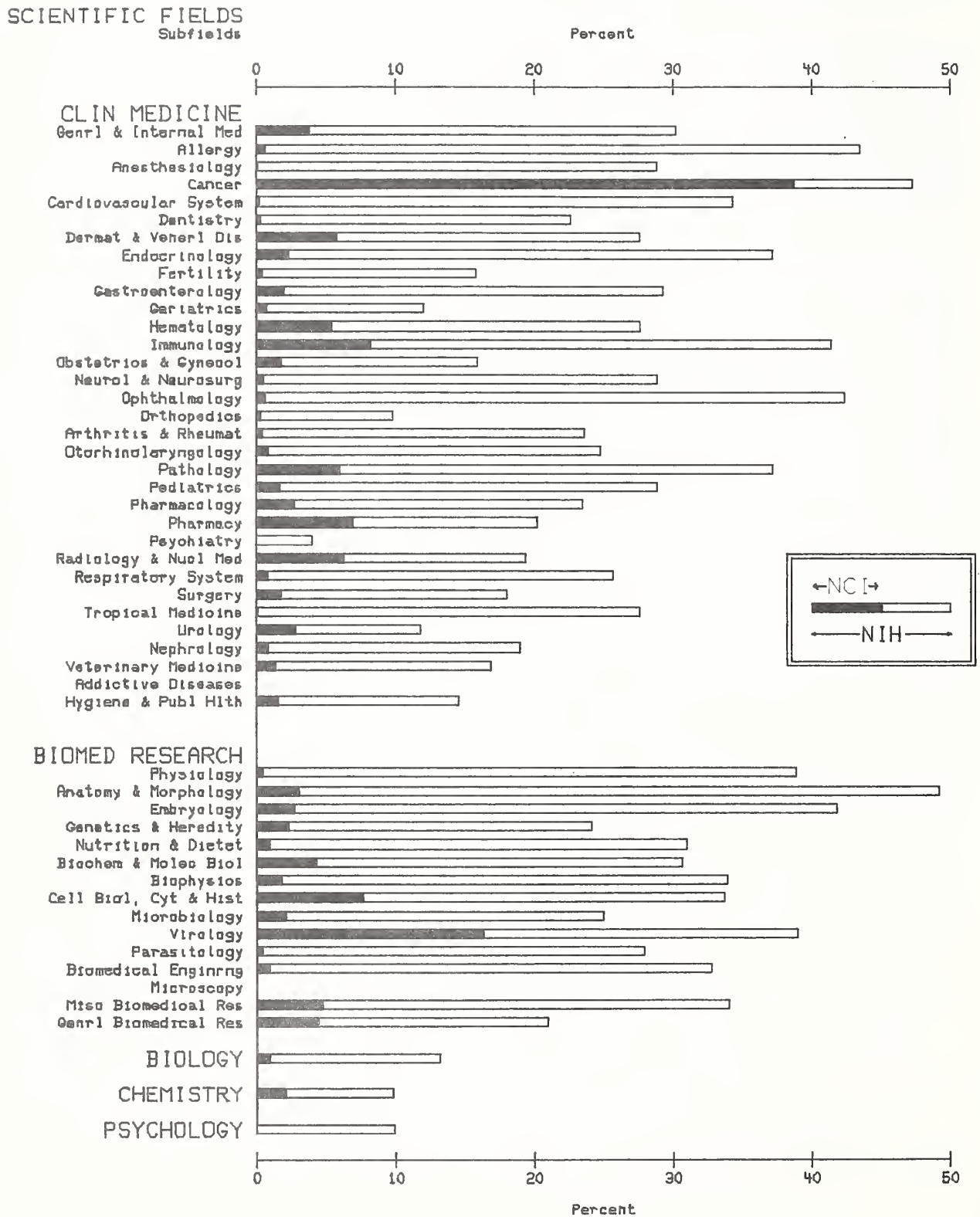
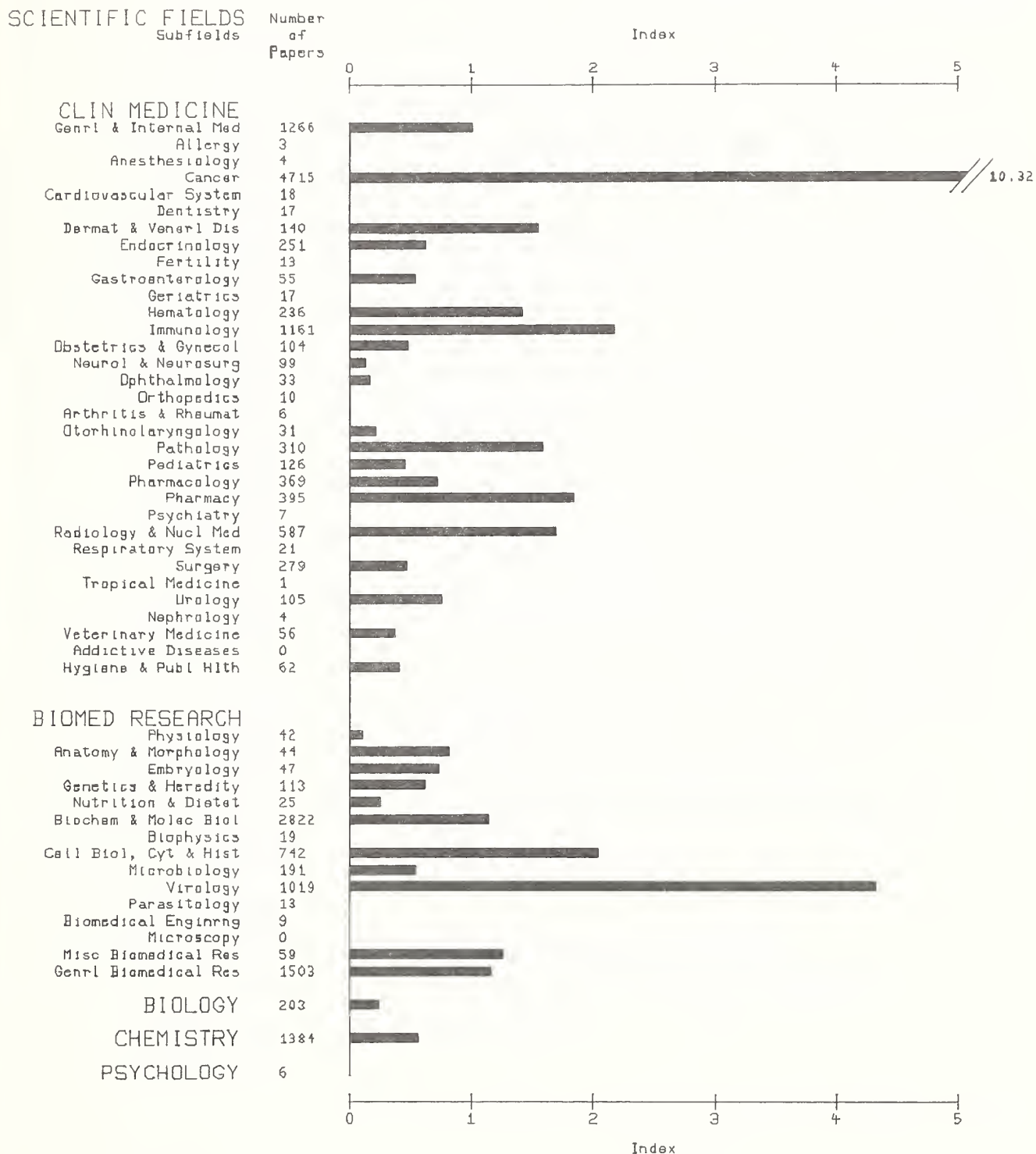


FIGURE 5 - NCI

Index of Concentration in Scientific Fields & Subfields
(1970-1976 combined, 275 Biomedical and Related Journals)

$$\text{INDEX} = \frac{\% \text{ of Institute's Papers in Field}}{\% \text{ of 275 Journals' Papers in Field}}$$



NOTE: No values shown for Scientific Fields or Subfields in which BID supported fewer than 25 papers.

CITATION PERFORMANCE

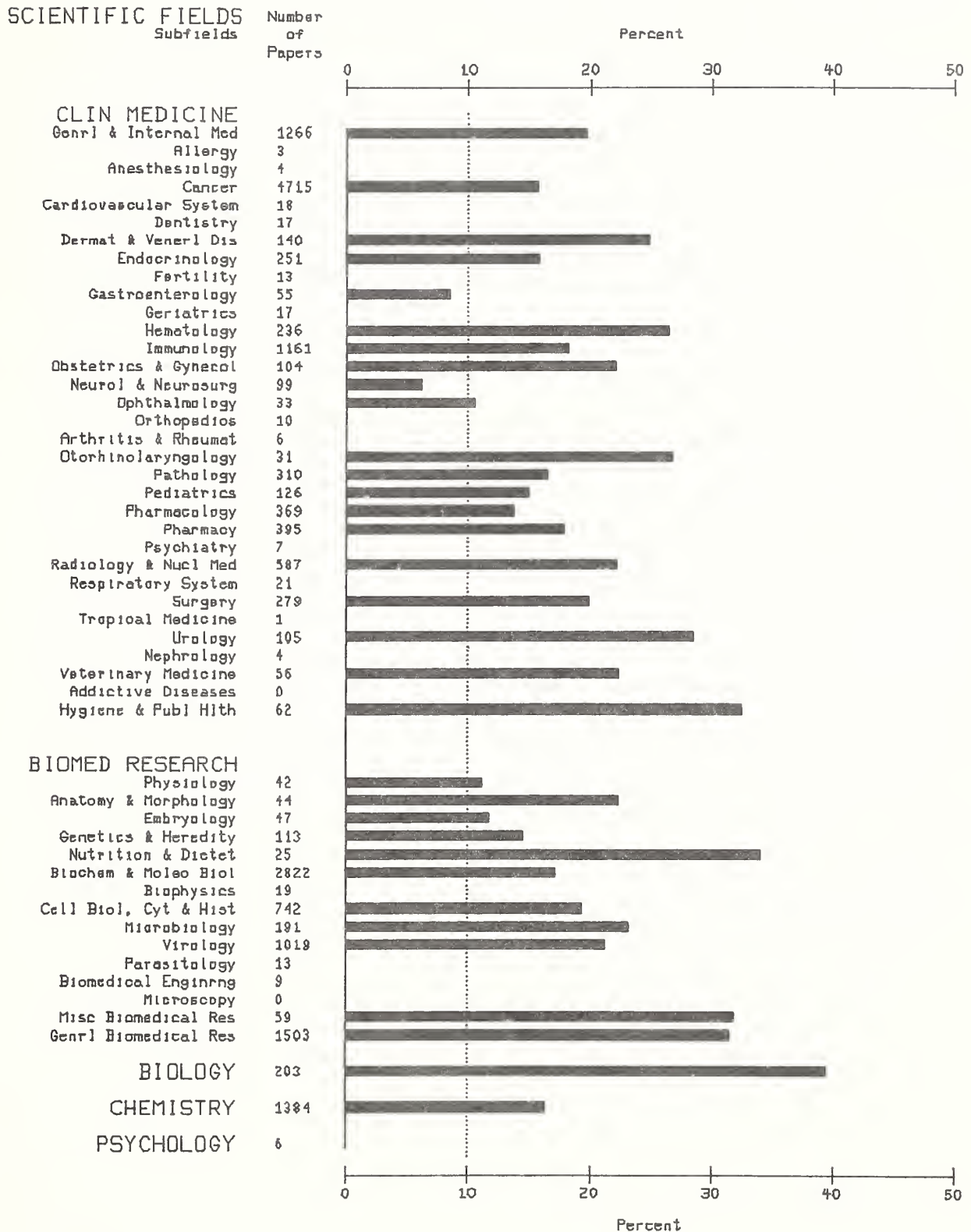
For any collection of papers it is characteristic that the distribution of the number of citations received is extremely skewed. In general, relatively few papers in a field are very highly cited and relatively many are cited once or twice or not at all. Given these skewed distributions, measures of central tendency are of limited value in analysis. One alternative way of assessing citation impact is to compare the frequency of highly cited papers between groups.

Figure 6 shows the percent of NCI supported papers that are in the top decile of cited papers in each subfield represented in the B/I/D journal set. This statistic has the advantage that a top decile is interpretable across both subfields and years even though the proportions are based on different numbers of citations in each cited year and in each subfield.

Graphic representations are limited arbitrarily to subfields in which the Institute supported more than 25 papers in the 1970-76 period. For NCI there are 31 such subfields. In 29 of the 31 subfields more than 10% of the NCI supported papers are in the top decile of cited papers, and in 25 of the subfields 15 to 34 percent of NCI supported papers are in the top decile. Reference to the column of T-score values for citations to NCI supported papers, given in Table 3, shows that, on the average, the frequency of citation for NCI papers is more than half a standard deviation above the mean for all papers in the aggregated subfields.

FIGURE 6 - NCI

% of BID's Papers in the Top Decile of Cited Papers
by Scientific Fields and Subfields
(1970-1976 combined, 275 Biomedical and Related Journals)



NOTE: No values shown for Scientific Fields or Subfields in which BID supported fewer than 25 papers.

B/I/D INTERDEPENDENCY

Another perspective on the bibliometric character of a B/I/D is provided by considering its referencing and citation interaction with other B/I/Ds.

Figure 7 is based on the references listed in NCI supported papers; it illustrates the dependence of NCI research on information supported by other sources. Only 37% of the references in NCI supported papers are to other NCI supported papers; 63% are to papers that were supported by others. Other Institutes on which NCI authors draw most often are NIAID, NIAMDD, and NIGMS, each cited in 5 to 6% of the NCI references. Altogether, only 15% of the NCI cites are to papers supported by sources outside the Federal government. The 13% of citations to papers that gave no support acknowledgement are likely to be to "clinical observation" papers, i.e., papers based on the observation by a physician in practice of notable experience with a small group of patients. Acknowledgements of sources of support outside the Federal government are often to such groups as the American Cancer Society, other private biomedical research support foundations, state and local governments, or private industry, such as a pharmaceutical company.

Figure 8 presents the converse of Figure 7, showing the citations received by NCI supported papers, according to the referencing source. Some 44% of the citations received by NCI papers are from papers supported by NCI, while 56% are from papers with other sources of support.

The NIH Institutes that cite NCI papers frequently (4-5% of NCI citations received) are NIAID, NIAMDD, and NIGMS, the same three Institutes that are referenced frequently by NCI supported authors. NCI received about 10% of its citations from papers that contained no support acknowledgements and 15% from authors supported by other than Federal government sources.

FIGURE 7: REFERENCES GIVEN BY NCI SUPPORTED PAPERS PUBLISHED IN 1973-1977 TO U.S. PAPERS PUBLISHED IN 1970-1976

Note: Size of circle proportional to # supported papers - one arrow for each 2% of references (Actual % indicated)

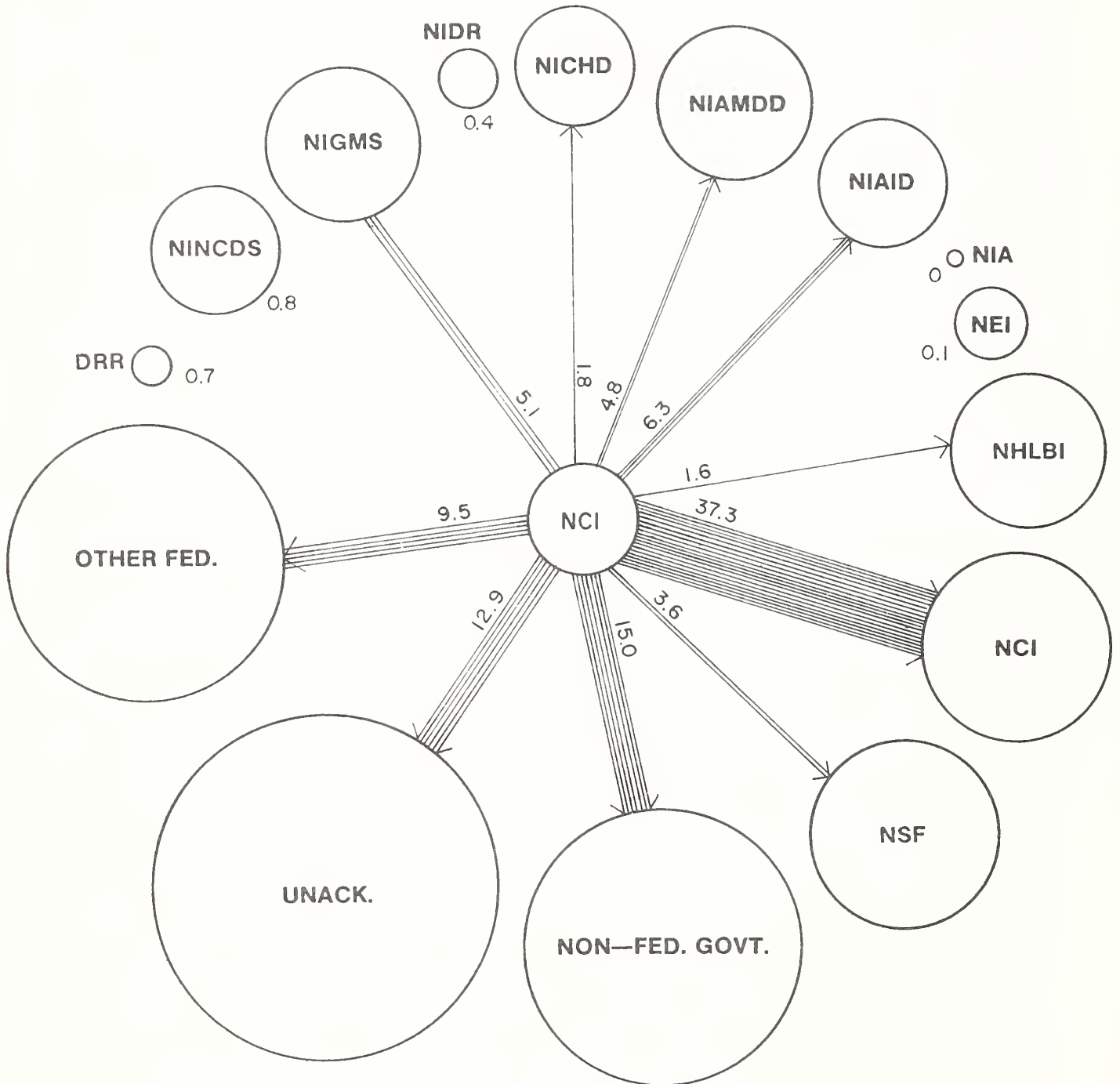
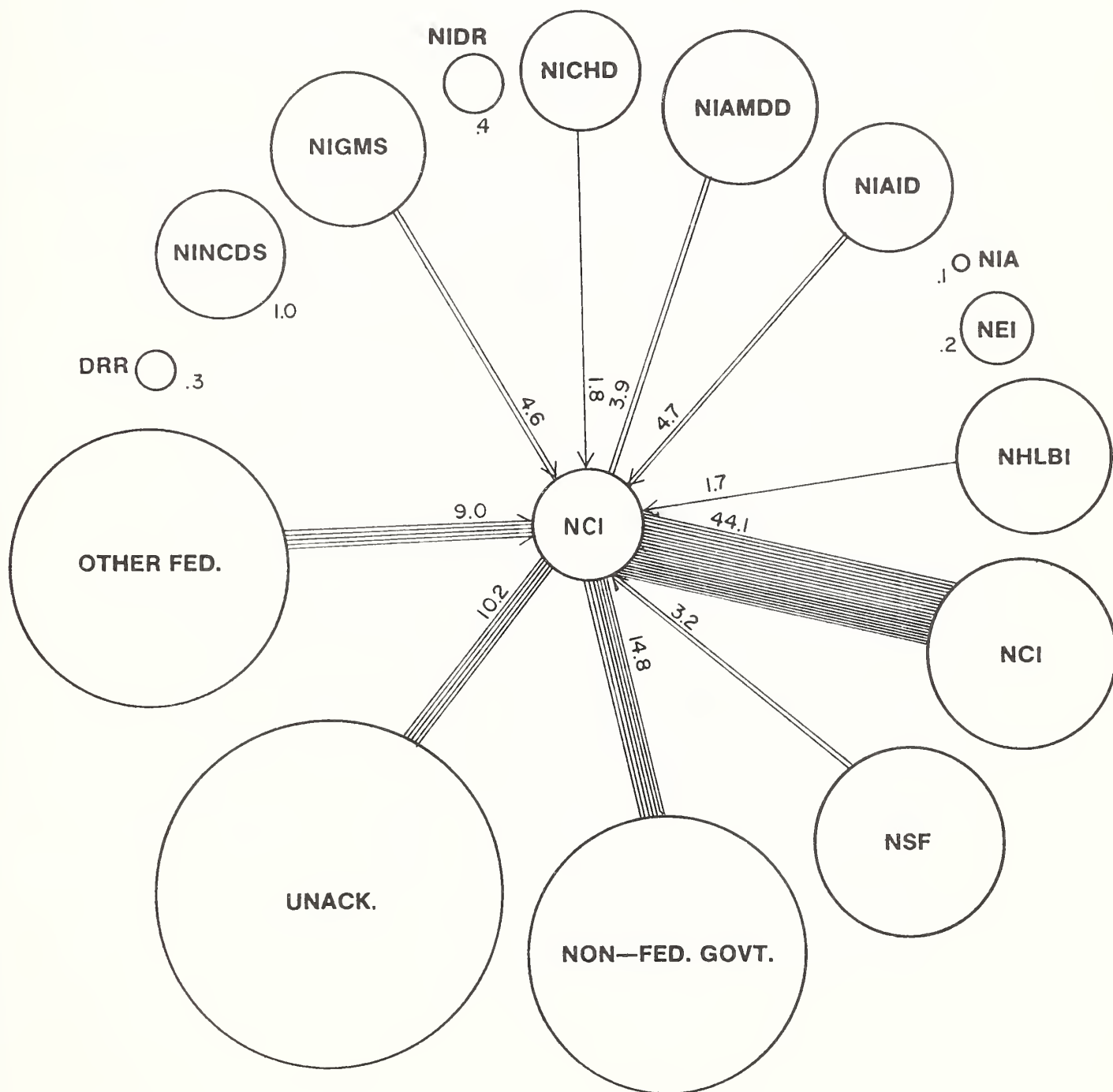


FIGURE 8: CITATIONS RECEIVED BY NCI SUPPORTED PAPERS PUBLISHED IN 1970-1976 FROM U.S. PAPERS PUBLISHED IN 1973-1977

Note: Size of circle proportional to # supported papers - one arrow for each 2% of citations (Actual % indicated)



HIGHLY CITED PAPERS

Tables 1 and 2 provide samples of information available about citations to individual papers. Table 1 lists the 10 most highly cited papers in the clinical subfield with which the Institute is most closely identified (usually the highest Activity Index). Table 2 lists the 10 most highly cited papers in the biomedical research subfield for which the Activity Index is highest. These lists are drawn from 1974 publications, and reflect all citations received by 1977. Inasmuch as no Institute has direct responsibility for the basic biomedical research subfields, and an individual Institute's interests may focus on only a single specialty area within one of these broadly defined disciplines, there is no basis on which to expect that any particular Institute will have supported a proportion of the most highly cited papers in a basic science subfield. For the clinical subfields, expectations may be more specific.

Lists of the 25 most highly cited papers supported by each Institute in its fields of concentration, and lists of the 25 most highly cited papers in each subfield and at each research level, for each year 1970 through 1976 are available in the Program Evaluation Branch, OD, NIH (496-4418). Information provided in these lists includes citation frequency rank, the number of citations received in each year, 1973 through 1977, journal identification, author(s), title, level, field and subfield (L/F/S).

TABLE 1: 10 MOST HIGHLY CITED PAPERS FOR SUBFIELD CANCER
 IN 1974: CITING YEARS 1973-77 INCLUSIVE: CITED AND
 CITING PAPERS FROM 275 JOURNAL SET

Rank	Total Cites Received	Cites Received by Citing Year				
		77	76	75	74	
1	77	37	26	13	1	"Immunologic Characterization of Human Malignant Lymphomas" by R. J. Lukes; R. D. Collins CANCER, Vol 34, Pg. 1488 Support Source: All Unacknowledged/ Unidentified Corp. Address: USC Med, LA
2	63	24	20	19	0	"High-pressure Liquid Chromatographic Analysis of Benzo(Alpha)Pyrene Metabolism and Covalent Binding..." by J. K. Selkirk; R. G. Croy; P. P. Roller; H. V. Gelboin CANCER RES, Vol. 34, Pg. 3474 Support Source: NCI Corp. Address: NIH
3	60	16	24	18	2	"Disappearance of a Major Cell-type Specific Surface Glycoprotein Antigen (SP) After Transformation..." by A. Vaheri; E. Ruoslanti INT J CANC, Vol. 13, Pg. 579 Support Source: All Unacknowledged/ Unidentified Corp. Address: Fdn Chl Hos Med
4	58	18	18	15	7	"Relationship between Epstein-Barr Virus (EBV) DNA and the EBV-Determined Nuclear Antigen (EBNA) in ..." by T. Lindahl; G. Klein; B. M. Reedman; B. Johansson; S. Singh INT J CANC, Vol. 13, Pg. 764 Support Source: NCI Corp. Address: Fdn Chl Hos Med
5	53	23	24	6	0	"Two Forms of Repair in the DNA of Human Cells Damaged by Chemical Carcinogens and Mutagens" by J. D. Regan; R. B. Setlow CANCER RES, Vol. 34, Pg. 3318 Support Source: NCI; ERDA Corp. Address: Oak Ridge Labs

TABLE 1: 10 MOST HIGHLY CITED PAPERS FOR SUBFIELD CANCER
 IN 1974: CITING YEARS 1973-77 INCLUSIVE: CITED AND
 CITING PAPERS FROM 275 JOURNAL SET (Continued)

Rank	Total Cites Received	Cites Received by Citing Year				
		77	76	75	74	
5	53	17	17	16	3	"Tumor Cytotoxicity in Vitro by Macro- phages from Mice Infected with Mycobacterium Bovis Strain BCG" by R. P. Cleveland; M. S. Meltzer; R. Zbar J NAT CANC, Vol. 52, Pg. 1887 Support Source: NCI Corp. Address: NIH
7	48	11	16	14	7	"Childhood Lymphoblastic Lymphoma, A Cancer of Thymus-Derived Lymphocytes" by J. Kaplan, R. Mastrangelo, W. D. Peterson, Jr. CANCER RES, Vol. 34, Pg. 521 Support Sources: NCI, NIH Corp. Address: Wayne St Med and other
7	48	21	15	11	1	"Heterotransplantation of Human Malignant Tumors in "Nude Thymusless Mice. II. Malignant Tumors Induc..." by B. C. Giovanella, J. S. Stehlin, L. J. Williams, Jr. J NAT CANC, Vol. 52, Pg. 921 Support Sources: Private Non-profit Corp. Address: Unidentified
7	48	20	19	9	0	"Specificity of 51Cr-release Cytotoxicity of Lymphocytes Immune to Murine Sakcoma Virus" by R. B. Herberman, T. Aoki, M. Nunn, D. H. Lavrin, N. Soares, A. Gazdar, H. Holden, K. S. Chang J NAT CANC, Vol. 53, Pg. 1103 Support Sources: NCI Corp. Address: NIH and other
7	48	19	17	10	2	"Inhibition of Leukocyte Migration by Tumor- Associated Antigens in Soluble Extracts of Human Breast Cancer" by J. L. McCoy, L. F. Jerome, J. H. Dean, G. B. Cannon, T. C. Alford, T. Doering, R. B. Herberman J NAT CANC. Vol. 53, Pg. 11 Support Sources: NCI Corp. Address: Geo Wash U, DC., Med Col SC, Chrleston, NIH

TABLE 2: 10 MOST HIGHLY CITED PAPERS FOR SUBFIELD VIROLOGY
IN 1974: CITING YEARS 1973-77 INCLUSIVE: CITED AND
CITING PAPERS FROM 275 JOURNAL SET

Rank	Total Cites Received	Cites Received by Citing Year				
		77	76	75	74	
1	122	44	40	30	8	"A Proposed Nomenclature for the Virion Proteins of Oncogenic RNA Viruses..." by J. T. August; D. P. Bolognesi; E. Fleissner; R. V. Gilden; R. C. Nowinski VIROLOGY, Vol. 60, Pg. 595 Support Sources: All Unacknowledged/ Unidentified Corp. Address: Sloan-Ktrg, NY; Duke Med and other
2	95	22	25	25	23	"Structural Proteins of Mammalian Oncogenic RNA Viruses: Multiple Antigenic Determinants of the Major..." by M. Strand; J. T. August J VIROLOGY, Vol. 13, Pg. 171 Support Sources: General Medical Sciences Corp. Address: Alb Einst, Yeshiva
3	79	39	30	10	0	"Analysis of Endonuclease R-EcoRI Fragments of DNA from Lambdoid Bacteriophages and other Viruses by..." by R. B. Helling; W. M. Goodman; H. W. Boyer J VIROLOGY, Vol. 14, Pg. 1235 Support Sources: NCI, General Medical Sciences, Private Non-profit Corp. Address: U Cal Med, S Fran; U Mich, Ann Arbr
4	72	24	23	19	6	"Identification of Biological Activities of Paramyxovirus Glycoproteins. Activation of Cell Fusion, H..." by A. Scheid; P. W. Choppin VIROLOGY, Vol. 57, Pg. 475 Support Sources: NIAID, Private Non- profit Corp. Address: Rockflr U, NY
5	67	23	18	14	12	"Complementation Analysis of Simian Virus 40 Mutants..." by J. Y. Chou; R. G. Martin J VIROLOGY, Vol. 13, Pg. 1101 Support Sources: NIAMD Corp. Address: NIH

TABLE 2: 10 MOST HIGHLY CITED PAPERS FOR SUBFIELD VIROLOGY
IN 1974: CITING YEARS 1973-77 INCLUSIVE: CITED AND
CITING PAPERS FROM 275 JOURNAL SET (Continued)

Rank	Total Cites Received	Cites Received by Citing Year				
		77	76	75	74	
6	66	20	23	18	5	"Changes in Membrane Polypeptides that Occur when Chick Embryo Fibroblasts and NRK Cells are Transfor..." by K. R. Stone; R. E. Smith; W. K. Joklik VIROLOGY, Vol. 58, Pg. 86 Support Sources: NIAID; NIH Corp. Address: Duke Med
7	61	20	18	18	5	"Transcription of DNA from the 70S RNA of Rous Sarcoma Virus. I. Identification of a Specific 4S RNA..." by J. E. Dahlberg; R. C. Sawyer; J. Taylor; A. J. Faras; W. E. Levinson; H. M. Goodman; J. M. Bishop J VIROLOGY, Vol. 13, Pg. 1126 Support Sources: NCI, NIAID, NSF Corp. Address: U Cal Med, S Fran, U Wisc Med
8	55	11	11	21	12	"Detection of Baboon Type C Viral Sequences in Various Primate Tissues by Molecular Hybridization..." by R. E. Benveniste; R. Heinemann; G. L. Wilson; R. Callahan; G. J. Todaro J VIROLOGY, Vol. 14, Pg. 56 Support Sources: NCI, United Cerebral Palsy Corp. Address: NIH and other
9	52	5	15	18	14	"Primate and Murine Type-C Viral Nucleic Acid Association Kinetics: Analysis of Model Systems and Nat..." by E. M. Scolnick; W. Parks; T. Kawakami; D. Kohne; H. Okabe; R. Gilden; M. Hatanaka J VIROLOGY, Vol. 13, Pg. 363 Support Sources: NCI Corp. Address: U Cal, Davis; NIH, and other
10	51	16	20	12	3	"Mink Cell Line MV 1 Lu (CCL 64). Focus Formation and the Generation of "Nonproducer Transformed Cel..." by I. C. Henderson; M. M. Lieber; G. J. Todaro VIROLOGY, Vol. 60, Pg. 282 Support Sources: NCI Corp. Address: NIH

PUBLICATION PROFILE

Table 3 is a B/I/D publication profile that summarizes bibliometric activity for the Institute for the period 1970-1977. The Table counts all papers published in the B/I/D journal set in the years 1970 through 1976 and counts citations received by these papers from 1973 through 1977.

The first page of the Profile presents the data for all fields combined, for each Research Level and for each of the Major Fields. Page 2 lists the individual subfields of Clinical Medicine and page 3 lists the individual subfields of Biomedical Research. Following are definitions of the column headings:

- 1 Number of Papers - the fractional number of papers supported by this B/I/D in the particular Level, Field and Subfield (L/F/S).
- 2 Activity Index - proportion of the B/I/D's papers in the particular L/F/S divided by the proportion of all papers in the B/I/D journal set in the particular L/F/S.
- 3 % Internal Effort - Percent of the B/I/D's papers in the particular L/F/S.
- 4 % External Effort - Percent of all papers in the B/I/D journal set in the particular L/F/S supported by this B/I/D.
- 5 Total Cites - Total citations (from all journals in B/I/D journal set for citing years 1973 - 1977) received by the papers supported by this B/I/D in the particular L/F/S. Scaled to the average citation rate for each L/F/S in 1972.
- 6 Cites per Paper - Total scaled citations received divided by the number of papers supported.
- 7 Cite T-Score - This BID's citations per paper minus the average citations per paper for all papers in the particular L/F/S, divided by the standard deviation of citations per paper for all papers in the particular L/F/S. The statistic is scaled to a mean of 50 and standard deviation of 10.
- 8 % Papers Among the Top 10% - Percent of this BID's papers in the particular L/F/S that are among the top 10% of the most highly cited of all papers in the particular L/F/S.

Please note that although the publication profile presents analyses for any number of papers, the data are likely to be unstable when based on aggregates of less than about 25. The skewness of citation distributions permits only approximate statements about confidence limits; however, it may be said that to achieve a 95 percent confidence interval of ± 2 citations, a sample size of 20 is required.

BID PUBLICATION PROFILES

CANCER INSTITUTE - NCI

CITED YEAR : 1970 - 76

BASED ON CITES RECEIVED FROM ALL CITING YEARS 1973-77

CITED AND CITING ARTICLES FROM 293 BID JOURNAL SET

LEVEL/FIELD/SUBFIELD	NUMBER PAPERS	ACTIV INDEX	% INT EFFRT	% EXT EFFRT	TOTAL* CITES	CITES* PER PAPER	CITE T-SCR	% PAPERS AMONG TOP 10%
FIELDS [1-9]	18764.	1.00	100.00	3.75	225123.	12.0	55.70	23.89
CLINICAL-MIX [1-2]	3424.	0.67	18.25	2.51	29208.	8.5	58.14	27.83
CLIN INVESTIGATN [3]	7138.	1.73	38.04	6.48	73114.	10.2	55.74	20.38
BASIC RESEARCH [4]	8202.	0.86	43.71	3.23	121818.	14.9	55.89	25.92
CLIN MEDICINE [1]	10502.	1.26	55.97	4.73	103072.	9.8	56.09	22.52
BIOMED RESEARCH [2]	6645.	1.16	35.42	4.35	115084.	17.3	56.14	23.33
BIOLOGY [3]	203.	0.24	1.08	0.90	3324.	16.4	57.06	39.44
CHEMISTRY [4]	1384.	0.56	7.37	2.10	7860.	5.7	52.37	16.29
PHYSICS [5]	25.	0.05	0.13	0.17	98.	3.9	49.54	9.33
EARTH & SPACE SC [6]	0.	0.00	0.00	0.00	0.	0.0	0.00	0.00
ENGRNG & TECHNOL [7]	0.	0.00	0.00	0.00	0.	0.0	0.00	0.00
PSYCHOLOGY [8]	6.	0.01	0.03	0.02	21.	3.7	53.32	14.71
MATHEMATICS [9]	0.	0.00	0.00	0.00	0.	0.0	0.00	0.00

*Scaled to cited year 1972

BID PUBLICATION PROFILES

CANCER INSTITUTE - NCI

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CITED AND CITING ARTICLES FROM 293 BID JOURNAL SET

LEVEL/FIELD/SUBFIELD	NUMBER PAPERS	ACTIV INDEX	% INT EFFRT	% EXT EFFRT	TOTAL* CITES	CITES* PER PAPER	CITE T-SCR	% PAPERS AMONG TOP 10%
CLIN MEDICINE [1]								
GENRL & INTERNAL MED	1266.	1.01	6.75	3.78	15020.	11.9	55.94	19.71
ALLERGY	3.	0.15	0.02	0.58	26.	7.7	51.03	10.00
ANESTHESIOLOGY	4.	0.04	0.02	0.14	22.	6.3	56.81	28.57
CANCER	4715.	10.32	25.13	38.69	49614.	10.5	52.52	15.76
CARDIOVASCULAR SYSTM	18.	0.05	0.10	0.20	103.	5.8	47.14	8.41
DENTISTRY	17.	0.07	0.09	0.27	56.	3.2	55.31	26.92
DERMAT & VENERL DIS	140.	1.55	0.75	5.81	659.	4.7	56.20	24.91
ENDOCRINOLOGY	251.	0.62	1.34	2.32	2953.	11.8	53.95	15.87
FERTILITY	13.	0.11	0.07	0.40	51.	3.8	48.46	0.00
GASTROENTEROLOGY	55.	0.54	0.29	2.03	386.	7.0	50.78	8.51
GERIATRICS	17.	0.20	0.09	0.73	18.	1.0	48.95	9.62
HEMATOLOGY	236.	1.42	1.26	5.32	2426.	10.3	56.98	26.39
IMMUNOLOGY	1161.	2.18	6.19	8.18	18396.	15.8	54.65	18.24
OBSTETRICS & GYNECOL	104.	0.48	0.55	1.81	582.	5.6	53.70	22.15
NEUROL & NEUROSURG	99.	0.13	0.53	0.50	598.	6.0	48.04	6.23
OPHTHALMOLOGY	33.	0.17	0.18	0.65	151.	4.5	51.83	10.50
ORTHOPEDICS	10.	0.09	0.05	0.33	64.	6.3	63.03	45.90
ARTHRITIS & RHEUMAT	6.	0.12	0.03	0.45	61.	11.2	67.03	42.42
OTORHINOLARYNGOLOGY	31.	0.22	0.17	0.84	96.	3.1	55.37	26.74
PATHOLOGY	310.	1.59	1.65	5.95	2005.	6.5	54.63	16.60
PEDIATRICS	126.	0.46	0.67	1.72	747.	5.9	52.98	15.06
PHARMACOLOGY	369.	0.72	1.97	2.70	2852.	7.7	51.86	13.81
PHARMACY	395.	1.84	2.11	6.91	1784.	4.5	53.00	17.88
PSYCHIATRY	7.	0.03	0.04	0.11	35.	5.1	54.13	19.51
RADIOLOGY & NUCL MED	587.	1.69	3.13	6.35	2815.	4.8	53.06	22.21
RESPIRATORY SYSTEM	21.	0.22	0.11	0.84	93.	4.4	49.99	9.52
SURGERY	279.	0.47	1.49	1.75	1692.	6.1	56.14	19.90
TROPICAL MEDICINE	1.	0.04	0.01	0.13	3.	2.5	47.03	25.00
UROLOGY	105.	0.75	0.56	2.81	396.	3.8	55.96	28.48
NEPHROLOGY	4.	0.21	0.02	0.80	7.	2.1	50.57	0.00
VETERINARY MEDICINE	56.	0.37	0.30	1.38	113.	2.0	53.39	22.32
ADDICTIVE DISEASES	0.	0.00	0.00	0.00	0.	0.0	0.00	0.00
HYGIENE & PUBL HLTH	62.	0.41	0.33	1.55	268.	4.3	57.86	32.44
MISC CLINICAL MED	0.	0.00	0.00	0.00	0.	0.0	0.00	0.00

*Scaled to cited year 1972

BID PUBLICATION PROFILES

CANCER INSTITUTE - NCI

CITED YEAR : 1970 - 76

BASED ON CITES RECEIVED FROM ALL CITING YEARS 1973-77

CITED AND CITING ARTICLES FROM 293 BID JOURNAL SET

LEVEL/FIELD/SUBFIELD	NUMBER PAPERS	ACTIV INDEX	% INT EFFRT	% EXT EFFRT	TOTAL* CITES	CITES* PER PAPER	CITE T-SCR	% PAPERS AMONG TOP 10%
BIOMED RESEARCH [2]								
PHYSIOLOGY	42.	0.11	0.22	0.41	417.	10.0	50.64	11.16
ANATOMY & MORPHOLOGY	44.	0.81	0.23	3.03	249.	5.7	53.04	22.35
EMBRYOLOGY	47.	0.73	0.25	2.72	342.	7.3	49.80	11.74
GENETICS & HEREDITY	113.	0.61	0.60	2.29	868.	7.7	52.85	14.48
NUTRITION & DIETET	25.	0.25	0.13	0.93	205.	8.2	61.47	34.00
BIOCHEM & MOLEC BIOL	2822.	1.14	15.04	4.29	44857.	15.9	53.55	17.14
BIOPHYSICS	19.	0.48	0.10	1.79	161.	8.3	54.54	25.00
CELL BIOL CYT & HIST	742.	2.04	3.95	7.63	9297.	12.5	54.62	19.38
MICROBIOLOGY	191.	0.54	1.02	2.04	1510.	7.9	56.22	23.19
VIROLOGY	1019.	4.33	5.43	16.26	19723.	19.4	58.02	21.21
PARASITOLOGY	13.	0.10	0.07	0.39	36.	2.8	53.12	18.42
BIOMEDICAL ENGINRNG	9.	0.25	0.05	0.95	52.	6.0	76.58	38.46
MICROSCOPY	0.	0.00	0.00	0.00	0.	0.0	0.00	0.00
MISC BIOMEDICAL RES	59.	1.26	0.32	4.71	87.	1.5	53.10	31.83
GENRL BIOMEDICAL RES	1503.	1.17	8.01	4.39	37961.	25.3	57.56	31.44

*Scaled to cited year 1972

CROSSCUTTING RESEARCH

Table 4 opens a small window on the breadth of relations between biomedical disciplines and the programmatic interests of NIH. Shown in the table are the clinical medical fields and basic bioscience disciplines that were supported by more than one NIH Institute as reflected in 1970-1977 publications. One hundred papers is the arbitrary minimum number of papers used here to define significant involvement. During this period, only one BID was significantly involved with the production of publications in the following disciplines:

- Respiratory System (NHLBI - 384 papers)
- Tropical Medicine (NIAID - 210 papers)
- Hygiene and Public Health (NIAID - 121 papers)
- Parasitology (NIAID - 709 papers)
- Biomedical Engineering (NHLBI - 108 papers)

The fields and disciplines that have been most widely influenced by NIH programmatic interests (i.e. more than half the Institutes supported a significant number of papers) are:

- General and Internal Medicine
- Endocrinology
- Immunology
- Neurology and Neurosurgery
- Pathology
- Pediatrics
- Pharmacology
- Physiology
- Biochemistry and Molecular Biology

Table 4

Crosscutting Biomedical Subfields
Number of Papers > 100 Acknowledging Support of Each BID
1970-76 Papers in 275 Biomedical Journals

<u>BIDS</u> <u>Subfields</u>	<u>NCI</u>	<u>NEI</u>	<u>NIHLRI</u>	<u>NIAMD</u>	<u>NIADDK</u>	<u>NICIDJ</u>	<u>NIOR</u>	<u>NIIGMS</u>	<u>NIINGDS</u>	<u>DRR</u>
Gen. & Int. Medicine	1266	-	2251	1065	2460	551	111	654	315	338
Anesthesiology	-	-	127	-	-	-	-	434	-	-
Cancer	4715	-	-	137	130	-	-	175	-	-
Cardiovascular System	-	-	2578	-	-	-	-	113	-	-
Dermat. & VD	140	-	-	-	341	-	-	-	-	-
Endocrinology	251	-	213	-	1671	966	-	129	143	162
Hematology	236	-	453	-	224	-	-	-	-	-
Immunology	1161	-	273	2698	660	113	111	275	-	-
Obstetrics & Gynecology	104	-	-	-	-	377	-	-	-	-
Neurology & Neurosurgery	-	480	116	-	-	338	-	342	3651	116
Ophthalmology	-	1589	-	-	-	-	-	-	303	-
Pathology	310	-	463	135	336	-	-	157	113	-
Pediatrics	126	-	217	181	299	592	-	-	142	122
Pharmacology	369	-	561	-	308	136	-	717	492	-
Pharmacy	395	-	-	-	108	-	-	232	102	-
Radio. & Nucl. Medicine	587	-	320	-	-	-	-	427	129	-
Surgery	279	-	1019	-	566	-	-	393	-	-
Urology	105	-	-	-	162	-	-	-	-	-

<u>BIDS</u> <u>Subfields</u>	<u>NCI</u>	<u>NEI</u>	<u>NIHBI</u>	<u>NIHID</u>	<u>NIADDK</u>	<u>NIHID</u>	<u>NIHDI</u>	<u>NIHMS</u>	<u>NIHNCDS</u>	<u>NIHRR</u>
Physiology	-	136	1495	-	736	155	-	357	624	-
Anatomy & Morphology	-	-	-	-	-	151	-	-	107	-
Embryology	-	-	-	-	-	282	-	139	-	-
Genetics & Heredity	113	-	-	-	-	109	-	612	-	-
Nutrition & Diet	-	-	-	-	372	101	-	-	-	-
Biochem. & Molec. Bio.	2822	141	2202	1193	4869	1153	261	4967	877	253
Cell Biol. Cyto. & Hist.	742	-	235	166	410	337	156	649	253	-
Microbiology	191	-	-	848	203	-	-	699	-	-
Virology	1019	-	-	855	-	-	-	310	-	-

APPENDIX A: LIST OF FORMAL REPORTS AND PAPERS

NIH EVALUATION PROJECT NIH 73-2

Published Papers

1. Narin, Francis, Pinski, Gabriel and Gee, Helen. Structure of the Biomedical Literature. Journal of the American Society for Information Science 27, 1, 25-45, Jan.-Feb. 1976.
2. Frame, J. Davidson, and Narin, Francis. NIH Funding and Biomedical Publication Output. Federation Proceedings, 35, 14, 2529-2532, Dec., 1976.
3. Frame, J. Davidson and Narin, Francis. International Distribution of Biomedical Publications. Federation Proceedings, 36, 6, 1790-1795, May, 1977.
4. Narin, Francis and Shapiro, Rosalie T. The Extramural Role of the NIH as a Research Support Agency. Federation Proceedings, 36, 2470-2475, Nov., 1977.
5. Narin, Francis and Keith, Stephen B. The Intramural Role of the NIH as a Biomedical Research Institute. Federation Proceedings, 37, 2120-2123, June, 1978.

Reports:

6. Evaluation of Linkage Between Research Publications and NIH Funding. Summary of Work. March 73 - June 74. (Prepared by Francis Narin), Sept. 1974.
7. Structure of the Biomedical Literature. (Prepared by Gabriel Pinski), November, 1975.
8. Distribution of International Biomedical Literature. (Prepared by J. Davidson Frame), June 1976.
9. Profiles of Supported Research Publications - For NIH B/I/D's in 1973 and Other Biomedical Research Support Agencies. (Prepared by Rosalie T. Shapiro), September 1976.
10. Cross Institute Integration of Research Supported by NIH. (Prepared by Francis Narin, Rosalie Shapiro and Gabriel Pinski). Delivered at Second Annual Meeting, Society for Social Studies of Science, October, 1977.

11. Multi-dimensional Scaling Models of Subfield and B/I/RD Interactions. (Prepared by Gabriel Pinski), December, 1977.
12. Bibliometric Characterization of Research Papers from U.S. Medical Schools. (Prepared by Paul McAllister and Francis Narin), Delivered at Third Annual Meeting, Society for Social Studies of Science, Nov. 1978. Being updated for journal submission.
13. Trends in NIH Funding and the Production of Biomedical Papers. (Prepared by J. Davidson Frame, Francis Narin and Helen H. Gee), March, 1980. (To be submitted for Journal publication.)
14. Bibliometric Characterization of Transient and Resident Scientists in a Specialty Area. (Manuscript in preparation by Francis Narin and D. Wagner)

Related Documents

15. Narin, Francis. Evaluative Bibliometrics: The Use of Publication and Citation Analysis in the Evaluation of Scientific Activity. National Science Foundation. March, 1976. Monograph: 456 pp. NTIS Accession #PB252339/AS.
16. Pinski, Gabriel and Narin, Francis. Citation Influence for Journal Aggregates of Scientific Publications: Theory, With Application to the Literature of Physics. Information Processing and Management 12(5), 297-312, 1976.
17. Science Citation Index. Copyright Institute for Scientific Information.
18. Science Indicators. 1972, 1974, 1976, 1978. Reports of the National Science Board, Washington, D.C.: Government Printing Office, 1973, 1975, 1977, 1979.

APPENDIX B: LISTING OF THE B/I/D JOURNAL SET BY SUBFIELD

GENRL & INTERNAL MED

AM J MED (L2)
 AM J MED SC (L2)
 ANN INT MED (L1)
 ARCH IN MED (L2)
 BIOCHEM MED (L3)
 CLIN CHEM (L3)
 CLIN CHIM A (L3)
 CLIN SC MOL (L3)
 J AM MED A (L1)
 J CHRON DIS (L1)
 J CLIN INV (L3)
 J LA CL MED (L3)
 LANCET (L2)
 MEDICINE (L2)
 N ENG J MED (L2)
 P SOC EXP M (L3)
 SOUTH MED J (L1)
 YALE J BIOL (L3)

ALLERGY

J ALLERG CL (L2)

ANESTHESIOLOGY

ANESTH ANAL (L2)
 ANESTHESIOLOG (L2)

CANCER

CANC CHEMOT (L3)
 CANCER (L2)
 CANCER RES (L3)
 INT J CANC (L3)
 J NAT CANC (L3)
 ONCOLOGY (L2)

DENTISTRY

AM J ORTHOD (L2)
 ARCH ORAL B (L3)
 J AM DENT A (L1)
 J DENT RES (L3)
 J PERIODONT (L2)
 ORAL SURG O (L2)
 PERIODONTIC

DERMAT & VENERL DIS

ARCH DERMAT (L2)
 J INVES DER (L3)

ENDOCRINOLOGY

DIABETES (L3)
 ENDOCRINOL (L3)
 GEN C ENDOC (L4)
 J CLIN END (L3)
 J ENDOCR (L3)
 METABOLISM (L3)
 NEUROENDOCR (L3)

FERTILITY

FERT STERIL (L2)
 J REPR FERT (L3)

GASTROENTEROLOGY

AM J DIG DI (L2)
 GASTROENTY (L2)

GERIATRICS

GERIATRICS (L1)
 GERONTOL (L1)
 J AM GER SO (L1)
 J GERONTOL (L2)

CARDIOVASCULAR SYSTM

AM HEART J (L2)
AM J CARD (L2)
CHEST (L1)
CIRCUL RES (L3)
CIRCULATION (L2)

IMMUNOLOGY

CLIN EXP IM (L2)
IMMUNOCHEM (L3)
IMMUNOLOGY (L3)
J EXP MED (L3)
J IMMUNOL (L3)
J INFEC DIS (L2)
J RETIC SOC (L3)
TRANSPLAN P (L3)
TRANSPLANT (L3)

OBSTETRICS & GYNECOL

AM J OBST G (L2)
OBSTET GYN (L1)

NEUROL & NEUROSURG

ARCH NE PSY (L1)
ARCH NEUROL (L2)
BRAIN RES (L4)
DEVELOP MED (L2)
EEG CL NEUR (L3)
EPILEPSIA (L2)
EXP BRAIN R (L4)
EXP NEUROL (L4)
J COMP NEUR (L4)
J NE EXP NE (L3)
J NE NE PSY (L2)
J NEUROCHEM (L4)
J NEUROSURG (L1)
J NEURPHYSL (L4)
NEUROLOGY (L2)
VISION RES (L4)

OPHTHALMOLOGY

AM J OPHTH (L2)
ARCH OPHTH (L2)
EXP EYE RES (L3)
INV OPHTH V (L3)

HEMATOLOGY

BLOOD (L3)
BR J HAEM (L3)
THROMB DIAT (L3)
VOX SANGUIN (L3)

ARTHRITIS & RHEUMAT

ANN RHEUM D (L2)
ARTH RHEUM (L2)

OTORHINOLARYNGOLOGY

ANN OTOL RH (L2)
ARCH OTOLAR (L1)
J SPEECH HE (L2)
LARYNGOSCOPI (L1)

PATHOLOGY

AM J CLIN P (L2)
AM J PATH (L3)
ARCH PATH (L2)
EXP MOL PAT (L3)
LAB INV (L3)

PEDIATRICS

AM J DIS CH (L2)
BIOL NEONAT (L3)
J PEDIAT (L2)
PEDIAT RES (L3)
PEDIATRICS (L2)

PHARMACOLOGY

BIOCH PHARM (L3)
CLIN PHARM (L2)
CURR THER R (L1)
EUR J PHARM (L3)
J CLIN PHAR (L1)
J PHARM EXP (L3)
MOLEC PHARM (L3)
NEUROPHARM (L3)
PHARM REV (L3)
PSYCHOPHARM (L3)
TOX APPL PH (L3)

ORTHOPEDICS

CLIN ORTHOP (L2)
J BONE JOIN (L1)
J BONE - AM V (L1)

PSYCHIATRY

AM J ORTHOP (L1)
AM J PSYCHI (L1)
ARCH G PSYC (L1)
ARCH NE PSY (L1)
BR J PSYCHI (L1)
DIS NER SYS (L1)
J NERV MENT (L1)
J PSYCH RES (L2)
PSYCHOS MED (L2)

RADIOLOGY & NUCL MED

AM J ROENTG (L1)
INV RADIOL (L2)
J NUCL MED (L2)
RADIAT RES (L4)
RADIOLOGY (L2)
SEM ROENTG (L1)

RESPIRATORY SYSTEM

AM R RESP D (L2)
CHEST (L1)
RESP PHYSL (L4)

SURGERY

AM J SURG (L1)
ANN SURG (L1)
ARCH SURG (L1)
J PED SURG (L1)
J SURG RES (L2)
J THOR SURG (L1)
J TRAUMA (L1)
PLAS R SURG (L1)
SURG GYN OB (L1)
SURGERY (L1)
T AM S ART (L1)

TROPICAL MEDICINE

AM J TROP M (L2)

PHARMACY

J MED CHEM (L3)
J PHARM SCI (L3)

NEPHROLOGY

NEPHRON (L2)

VETERINARY MEDICINE

AM J VET RE (L3)
J AM VET ME (L2)

HYGIENE & PUBL HLTH

AM J EPIDEM (L2)
AM J PUB HE (L1)
ARCH ENV HE (L2)
B WHO (L2)

PHYSIOLOGY

AM J PHYSL (L4)
ANN R PHYSL (L4)
J APP PHYSL (L4)
J GEN PHYSL (L4)
J PHYSL LON (L4)
LIFE SCI P1 (L4)
PHYSIOL REV (L4)

ANATOMY & MORPHOLOGY

AM J ANAT (L4)
ANAT REC (L4)

EMBRYOLOGY

DEVELOP BIO (L4)
TERATOLOGY (L4)

GENETICS & HEREDITY

AM J HU GEN (L3)
ANN HUM GEN (L3)
BIOCHEM GEN (L4)
CHROMOSOMA (L4)
GENETICS (L4)
MUTAT RES (L4)

UROLOGY

INV UROL (L2)
J UROL (L1)

BIOCHEM & MOLEC BIOL

ANALYT BIOC (L4)
ANN R BIOCH (L4)
ARCH BIOCH (L4)
BIOC BIOP A (L4)
BIOC BIOP R (L4)
BIOCHEM (L4)
BIOCHEM J (L4)
BIOPOLYMERS (L4)
COLD S HARB (L4)
EUR J BIOCH (L4)
FEBS LETTER (L4)
J BIOL CHEM (L4)
J LIPID RES (L4)
J MOL BIOL (L4)
J THEOR BIO (L4)
LIFE SCI P2 (L4)
LIPIDS (L4)
STEROIDS (L4)

BIOPHYSICS

ANN R BIOPH (L4)
BIOPHYS J (L4)
J BIOMECHAN (L4)

CELL BIOL CYT & HIST

ACT CYTOL (L2)
CALCIF TISS (L3)
EXP CELL RE (L4)
J CELL BIOL (L4)
J CELL PHYS (L4)
J HIST CYTO (L4)
J MEMBR BIO (L4)
J ULTRA RES (L4)
STAIN TECH (L4)

MICROBIOLOGY

ANN R MICRO (L4)
APPL MICROB (L4)
J BACT (L4)
J GEN MICRO (L4)

NUTRITION & DIETET

AM J CLIN N (L4)
J NUTR (L4)

PARASITOLOGY

EXP PARASIT (L4)
J PARASITOL (L4)
J PROTOZOOL (L4)

BIOMEDICAL ENGINRNG

COMPUT BIOM (L3)
IEEE BIOMED (L3)

MISC BIOMEDICAL RES

HUMAN BIOL (L3)
LAB ANIM SC (L3)

GENRL BIOMEDICAL RES

ANN NY ACAD (L4)
EXPERIENTIA (L4)
FED PROC (L4)
LIFE SCI (L4)
NATURE (L4)
P NAS US (L4)
SCIENCE (L4)

GENERAL BIOLOGY

ANN NY ACAD (L4)
EXPERIENTIA (L4)
NATURE (L4)
P NAS US (L4)
SCIENCE (L4)

GENERAL ZOOLOGY

AM ZOOLOG (L4)
J EXP ZOOL (L4)

VIROLOGY

J GEN VIROL (L4)
J VIROLOGY (L4)
VIROLOGY (L4)

BOTANY

PHYTOCHEM (L4)
PLANT PHYSL (L4)

AGRICULT & FOOD SCI

J AGR FOOD (L3)

DAIRY & ANIMAL SCI

J ANIM SCI (L3)
J DAIRY SCI (L3)

MISCELLANEOUS BIOL

AM J P ANTH (L4)

ANALYTICAL CHEMISTRY

ANALYT CHEM (L3)
J CHROMAT (L3)

ORGANIC CHEMISTRY

CARBOHY RES (L4)
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